



Need for translational neuroscience investigation gives rise to multidisciplinary research center

Joseph E. Kerschner, MD
Interim Dean and Executive Vice President, Medical College of Wisconsin

The many disorders we classify as neurological have diverse etiologies, consequences, and age of onset. They affect great numbers of Wisconsin residents and cut across all demographics.

Neurodegenerative diseases like Parkinson's and Alzheimer's take a tremendous societal toll, while multiple sclerosis affects residents of the northern United States with greater frequency than other regions of the US. Spinal cord and traumatic brain injuries are rare but often impact people in the prime of life. Seizure disorders and migraines typically are diagnosed in childhood or adolescence but tend to be life-long with few therapeutic options.

Psychiatric disorders also involve neuropathology. Drug and alcohol abuse alter brain function. Schizophrenia has a strong genetic component and appears midlife. More commonly, an estimated 10% to 20% percent of women (twice as high as the incidence in men) experience a debilitating episode of depression during their lives.

Resultant from this broad range of clinical pathologies, neuroscience research is proportionately diverse. This might be best demonstrated by the existence of 4 different National Institutes of Health institutes focused primarily on neuroscience research, while others have strong neuroscience components.

Despite the characteristics that distinguish them, all neurological disorders are

marked by changes in the functioning of the brain or other nervous tissues. In response, The Medical College of Wisconsin created the Neuroscience Research Center (Center), bringing investigators in these fields together not just in the spirit of collaboration, but in the activity of translational

where the burden for patients is profound and the need for increased knowledge is apparent. To do so, we will leverage areas of expertise at the Medical College, including imaging, proteomics, genomics, engineering, neurosurgery, cellular and molecular neuroscience, and cognition.

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research. The Center will foster, facilitate and grow multidisciplinary neuroscience research under the leadership of founding director Cecilia J. Hillard, PhD, Professor of Pharmacology and Toxicology. The Medical College also has invested in a new leader in the Department of Neurosurgery by promoting Dennis Maiman, MD, PhD, and is actively recruiting a new department chair in Neurology. Each of these additions is linked to increased emphasis in treating and researching neurologic disorders at the Medical College.

Research emphasis in the Center will be placed on (1) mechanisms of neurodegeneration and regeneration, (2) the impact of chronic pain on brain function, and (3) the role of stress and stress resilience on psychiatric and behavioral disorders – areas

The Center complements and interacts with the Medical College's Center for Imaging Research, capitalizing on our pioneering development of functional MRI, which remains an institutional strength. The Neuroscience Research Center engages faculty across more than 13 departments, so research encompasses myriad themes, including vision, hearing, neurotrauma, rehabilitation from injury and disease, memory, movement, sleep, addiction, and neuroprotection.

Using fundamental mechanisms as the entry point relevant to virtually any brain or nervous system disorder, the Center will enable cross pollination to engender new ideas and expedite the translation of discoveries to clinical applications that help patients in and beyond Wisconsin.

The overarching theme linking researchers in the Center is increased understanding of synapses and mechanisms involved in synaptic plasticity, the processes that increase or decrease the strength of synaptic communication between neurons in the nervous system. These processes underlie learning and memory, and are disrupted by neurodegeneration, chronic stress, chronic pain, and substance abuse.

We need an enhanced understanding of neurons to unlock information about diseases and how to mitigate their destructive effects on health. Disorders of aging and those of neurodegeneration all are cases of neurons dying. The trigger that induces them to die may be different, as are the parts of the brain affected, but the process is the same throughout the brain. Neuroscience Research Center activities will be aimed at learning how neurons die; finding a way to prevent that cellular death could have implications for many diseases.

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more we understand that the processes at the beginning of life and those at the end of life are very similar. Regenerating a neuron lost in a spinal cord injury or the excision of a brain tumor, for example, may be accomplished by turning on the genes that were active when those neurons were first formed in utero. Harnessing the processes in neurodevelopment may allow us to initiate the regeneration of nervous tissue to repair injury or reverse disease progression.

The Neuroscience Research Center will be a catalyst for advancing these research concepts and many others. Collaboration is essential because neurologic diseases are so complex—isolated efforts are not conducive to progress. An inclusive approach that attracts engaged neuroscience researchers will increase the Medical College's investigative output so resulting therapies can be achieved faster. With scores of people affected by neurological and psychiatric disorders, there is no time to lose.

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